SLIDE-OUT INFORMATION DISPLAY

BACKGROUND

Portable computing devices such as, e.g., personal digital assistants, display-enhanced cellular telephones, portable electronic document readers, and interactive electronic guidebooks are typically produced with displays that are limited in visual area because the portable computing devices are preferably designed to be conveniently carried in the human hand. This is particularly true where the display is integrated with the body of the portable electronic device.

Accordingly, it would be desirable to provide a display that can be stored in a small space, but can be subsequently opened into a form that is much wider than the device to which it is attached. Preferably, an opened display for a portable device should be rigid enough that the user does not have to provide separate support for the display or set the portable device on a flat supporting surface. It would be additionally advantageous for the display to be easily opened with one hand since the other hand is usually used to support the portable computing device.

There has been prior work on displays that can be expanded to a greater viewing area. For example, FIG. **1** shows a known four-segment hinged display device **100** as described in U.S. Pat. No. 6,088,220 titled Pocket Computer with Full-Size Keyboard. Each half of the display **100**, as shown, has been folded out along a respective pair of horizontal hinge arrangements **120**-**180**. Hinged displays of this kind require repetitive manual actions to open or close the display, and generally involve flex cabling across each hinge arrangement which introduces additional potential failure points to the display. Further, this type of display arrangement multiplies the number of segment boundaries which results in visible seams in the display unless additional steps are taken.

Published U.S. patent application Ser. No. 10/719,300, titled Collapsible Display Device and Methods for Using the Same, discloses a number of fold-up display geometries that use non-right-angle folds, twists and pivots to reduce the number of manual actions needed to open the display. For example, FIG. **2** shows a display **200** which consists of a number of display segments **220** that open around a pivot **240**. Also disclosed are fold-up displays similar to folding fans, twist-up displays using spring-like exterior rings, pop-up displays that apply "pop-up book" techniques, and umbrella displays that apply a hub-spoke umbrella action.

Roll-up displays utilizing flexible display materials have been proposed such as, e.g., the roll-up display **300** shown in FIG. **3** and disclosed in U.S. Pat. No. 6,498,597 titled Continuously Displayable Scroll-Type Display. The roll-up display device **300** utilizes a scroll-like flexible display medium **320** which is stored in a cylindrical magazine **340**. A practical issue arises from using a flexible display material which is preferably viewed flat, and which is also sometimes fragile.

One approach is to utilize an accordion-like support structure similar to the one disclosed in U.S. patent application Ser. No. 10/012,558 titled Mobile Terminal Device, Content Distribution System, Content Distribution Method, and Program for Executing Method Thereof. With reference to FIG. **4**, the roll-up display device **400** includes an accordion-like supporting structure **420** for supporting the flexible display material **440**. Other roll-up displays use a "bamboo scroll" type of supporting structure which provides lateral support, but does not provide longitudinal support. It should be noted that, while the roll-up configuration has the advantage of expanding for use and collapsing to a smaller area for storage, the area to which it collapses is still limited in its degrees of freedom by its constant width, as is the area to which it expands. In other words, although the display area can be changed in its length dimension, its width dimension is generally fixed.

Accordingly, it would be advantageous to introduce display configurations that overcome certain disadvantages of existing technologies.

INCORPORATION BY REFERENCE

Each of the following U.S. patent applications and U.S. patents is incorporated in its entirety by reference herein:

- Pocket Computer with Full-Size Keyboard, U.S. Pat. No. 6,088,220, filed Oct. 2, 1997;
- Collapsible Display Device and Methods for Using the Same, U.S. patent application Ser. No. 10/719,300, filed Nov. 21, 2003;
- Continuously Displayable Scroll-Type Display, U.S. Pat. No. 6,498,597, filed Oct. 28, 1999;
- Mobile Terminal Device, Content Distribution System, Content Distribution Method, and Program for Executing Method Thereof, U.S. patent application Ser. No. 10/012,558, filed Dec. 12, 2001;
- Black/White Cholesteric Bistable Display with Increased White Reflectivity, U.S. patent application Ser. No. 11/004,752 filed Dec. 3, 2004;
- Electronic Apparatus With a Foldable Display, U.S. Pat. No. 5,734,513, filed Apr. 3, 1996; and
- Desktop Manager for Graphical User Interface Based System with Enhanced Desktop, U.S. Pat. No. 5,835,090, filed Oct. 17, 1996.

BRIEF DESCRIPTION

An expanding electronic display is provided which includes two display sections, one of the two display sections being configured to be hidden from view when the expanding electronic display is in a first position. A movement mechanism permits movement of one of the display sections into a relationship to the remaining display section which permits viewing of both display sections concurrently.

A slide-out information display device is also provided which includes stacked display segments. Each of the display segments except one is at least partially covered by one or more of the remaining display segments. Bezel segments are provided for supporting the display segments, and are arranged such that the bezel segments are separable from each other in at least one direction, the stacked display segments being uncovered when the bezel segments are separated from a collapsed configuration to an un-collapsed configuration for use by a user. The uncovered display segments thereby provide an enlarged viewing area.

A roll-up display device is also provided which includes flexible display membranes. A pair of scrolling assemblies is included, one of which includes a rotatably mounted scrolling assembly mechanism for rolling up a first flexible display membrane. Additional scrolling assemblies are also provided, one of which includes a second rotatably mounted scrolling assembly mechanism for rolling up a second flexible display membrane. The additional scrolling assemblies are movable in at least one direction and can be extended beyond the first pair of scrolling assemblies, the second display membrane being covered by the first display membrane when the additional scrolling assemblies are not extended, and the second display membrane being uncovered when the additional scrolling assemblies are extended, thereby providing an enlarged viewing area.